Helping Third Grade Students with Addition Facts

An Honors Thesis (HONRS 499)

by

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Abstract

In response to the frustration felt by elementary teachers, I implemented a comprehensive mathematics instruction program for helping students learn their basic addition facts. Through a method John Van de Walle describes in detail, I taught 17 students in my third-grade student teaching placement how to use specific strategies every time they encountered an addition fact. The students successfully learned the strategies and improved their confidence and overall speed in solving addition facts. I used student interviews, observations, and timed tests to document the overall success of the students. I also included some personal reflection on how this project allowed me to grow professionally.

Acknowledgements

I want to thank Dr. Sheryl Stump for her help throughout the project. She was extremely supportive in both helping me implement the strategies and write the formal document.

I also want to thank Miss Pamela Reed who was willing to allow me to teach the strategies to the students in her third grade classroom. She served as a mentor as I began to develop my teaching style.

Timothy Brown

Helping Third Grade Students with Addition Facts

In the typical elementary classroom, students are expected to learn and master their addition facts through countless practice problems and rote memorization. Yet for many teachers, the biggest mathematical frustration is students not knowing their basic mathematics facts. For students, this creates a problem as the mathematical concepts build on each other and become more difficult. Students work with applications of new ideas, yet without a firm grasp of basic mathematics they become bogged down in the "simple" mathematics computations. The longer students go without knowing their facts, the longer they struggle through the related mathematical topics.

The difference for those students who successfully master their facts quickly is that they create mental schemes that they use each time they encounter a math fact. Although students and adults alike may not consciously think of it, we see a problem like, 8 + 5 = 13 and think of some strategy (8 + 2 = 10, 10 + 3 = 13). As adults, we have mastered these "strategies" to a point that we know the solution to a fact problem instantly because the strategies are automatic for us. The most exciting benefit of the strategies I implemented in the classroom is that they can become automatic for the students with repeated use (Van de Walle, 157).

I worked as a student teacher at Cowan Elementary School in Muncie, Indiana. During the fall semester, I had 17 students with a dramatic mix of ability levels. Throughout the day, five of the students would leave for an hour of additional support outside of the classroom according to their individual education plans. I taught mathematics instruction from the adopted Saxon mathematics curriculum. At the third grade-level, the curriculum consisted of a morning meeting, a mathematics lesson, and a two-page worksheet. The morning meeting consisted of daily practice of patterns, counting, temperature, word problems, time, and money. The daily lesson consisted of teacher directed activities that allowed students to learn and practice new ideas. With each new lesson, each student completed an in-class assignment with my assistance. They then each completed the backside of the sheet as homework. One staple of Saxon mathematics is its repetition. The front side of the daily worksheet is nearly identical to the back homework side. This allows students to look back on their work in class and use it to complete their homework.

One important aspect of the Saxon mathematics curriculum is that for every fifth lesson one day is devoted to fact practice. The facts the students learn are broken down into groups (1s, 2s, 3s . . .). The students are presented the groups of facts with numerous drill exercises. Through the drill exercises and limited instruction, the students are expected to master their addition facts. To help increase student retention, I wanted students to have strategies (cognitive schemes for attacking categories of mathematics facts to the point of automaticity) in place based on different criteria, not simply the fact groups. I wanted students to learn fact strategies that they could apply the second they viewed a fact.

In this summary, I will talk about how I incorporated direct mathematical fact strategy instruction into the established mathematics curriculum.

Decision to Teach Strategies

In talking with my classroom teacher and other teaching professionals, I quickly learned of the frustration teachers felt with their students not having mastered basic mathematics facts. I decided to use the method described by Van de Walle to help students develop strategies for mastering their addition facts (156-166). Before initiating the program, I gave the students each a page of problems (see appendix A) and asked them to complete all of them that they knew instantly. I also asked them to circle the problems that they had to stop and think about or those they had to use their fingers in order to obtain the solution. After the completion of the page of problems, I interviewed the students one-on-one to determine what they knew entering the strategies approach.

I learned that a few students in the classroom did already use some strategies in their addition work. The majority of the students had no strategies at all. In fact, most students simply counted on their fingers to find the answer to the problems with no apparent pattern. Other students said that they counted on their fingers by starting with the larger number and then counting on the smaller number. It was good to see that the students did have some number concepts already in place and that they could all benefit from strategy instruction.

Three-Step Process

John Van de Walle describes a three-step process to helping students master their facts. First, he emphasizes that students need to develop a strong understanding of the operations and of number relationships (157). Since the students I worked with were in third grade, most of them came into the class with a relatively strong understanding of the operation of addition. However, I quickly learned that many of them did not have a strong understanding of number relationships. For example, as adults we see the numbers 4 and 6 and automatically think of 10. Some of the students I worked with did not possess this relationship when we started. Therefore, before teaching a strategy, it was important for me to discuss number relationships.

The second key component is the actually development of efficient strategies. According to Van de Walle, an efficient strategy is one that can be done mentally and quickly (157). The often-popular approach of students counting on their fingers is not an effective strategy, even though many students continue to count on their fingers well into middle school. Throughout the entire semester, I worked with the students on seven specific strategies that covered all of the mathematics facts.

The third key component is to provide the students with drill so that they can practice the strategies that they have learned (Van de Walle, 157). One aspect that I tried to focus on was to continue to provide drill not only for the day's newly learned strategy, but for the previously learned strategies as well. The students need to be exposed to the strategies and their corresponding problems repeatedly for the strategies to become automatic. By mixing all the learned strategies, the students could keep each one fresh in their minds. Since the strategies are quite simple, it was possible for the students to practice their strategies for a short time everyday.

Implementation

Since the Saxon program was already in place in the classroom, it was very easy to implement the teaching of fact strategies. As I mentioned, every fifth lesson in Saxon focuses on fact work. During the first semester of third grade, the fact work Saxon provides is with addition facts. As a result, every fifth lesson I switched to Van de Valle's description of fact instruction. In the days between fact instruction, the students practiced their newly learned strategies with drill exercises and problems.

To help keep the students aware of the strategies they were learning, I kept a number matrix (see fig. 1) taped to the front of my desk at all times. After learning a strategy, a student volunteer colored in the corresponding facts completed using that strategy. This gave the students a visual example of the facts associated with each strategy and allowed them to see their progress in learning strategies for all of the possible addition facts. As we worked closer and closer to the learning strategies for all the facts and filling the entire matrix, the display served as a motivation for the students.

Figure 1

			Addition Facts							
+	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

With each strategy, I followed a standard plan (see fig. 2). First, I included any discussion of number relationships that was important for a particular fact strategy. For example, with one particular strategy I had to make sure that students clearly understood what facts come together to make ten and why these facts could help to increase the speed of the students' computation. For most of the categories, I went right into the introduction of the fact strategies. To do this, I first presented the students with a story problem involving some sort of addition fact. I felt that it was very important to introduce each strategy to the students beginning with a real-world story problem. To me, this helped set the purpose so the students could see a real application of the strategy they were learning.

One important aspect that I tried to incorporate into the word problems I presented to the class was to make sure that I gave a variety of different classifications of word problems. According to Judith Hankes, Cognitive Guided Instruction allows students to form their own strategy about how to solve a problem well before they receive any formal instruction on any particular strategies. Children are able to interpret and make sense of the problem using their own existing knowledge (453). I felt that this was very important to include in the strategy development because no one strategy is the best for any particular problem type. What is most important is that the strategy a student uses works for him or her. That is why the next portion of every lesson dealt with sharing solutions.

Figure 2

Standard Plan

Fact Category

Number Relationships: The essential number relationships needed by the students for the fact category

Problem: A real-world problem involving an addition fact in the category

Share Solutions: The time to convert the problem into symbols and for the students to share their possible strategies and solutions to the problem

Strategy: The time to present the strategy suggested by Van de Walle

Additional Problem: An additional real-world problem to allow the students to use their newly learned strategy

After reading the story problem, I asked volunteers to convert the problem into its symbols for the other students in the class. This way the students could see how a real-world problem would be converted into the symbols that they were accustomed to using. After converting the problem into symbols, we spent five to ten minutes discussing possible strategies to use to increase the speed in obtaining the solution to the problem.

During the discussion, the strategy I was planning to teach was usually suggested. If not, I led the students to the desired strategy through more examples. Again, allowing the students to discover the strategies on their own was much more beneficial than simply telling them a specific strategy to use.

We finished each mini-lesson with an additional problem involving the same addition fact category. This time through the numbers in the problem changed as well as the classification of the problem. In each lesson, this allowed the students to experience a fact group with at least two different classifications of problems.

I presented the strategies the same way that Van de Walle presents them in his descriptions (159-65). Looking at the order, I felt that the first few strategies were easier for the students to grasp than the last few strategies. I thought that it was important to ease the students into the learning of mathematical fact strategies by letting them start with the simplest. In addition, the final few strategies required the students to use the new knowledge that they had gained from the initial strategies. For all of these reasons, the strategies presented below are presented in the order I taught them in the classroom.

Strategies for Addition Facts

<u>One-More-Than Facts</u>

Figure 3

			Addition Facts							
+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Figure 4

One-More-Than Facts

Number Relationships: Students must see that it is much faster to start with a larger number and add on the smaller number than to start with a smaller number and add on a larger number.

Problem: Billy's baseball team scored eight runs in the baseball game. In the next game, the team scored one run. How many runs did the team score in the two games combined?

Share Solutions

Strategy: Teach the students to start with the larger number and mentally add one more to that number. In this case, start with 8 and add one more to make 9.

Additional Problem: Jenny has 3 blue hats and 1 red hat. How many hats does she have in all?

To begin the formal strategy instruction, I began with a relatively easy set of problems that still allowed the students to gain the understanding of how to use the strategies. The problems in this category all have at least one added that is 1 (see fig. 3). After presenting the initial story problem to the class, the group was a little unsure of what to use to solve the problem. The idea of a strategy puzzled them. With some encouragement, they began suggesting possible strategies. Some students suggested starting with the top number and then adding 1. We tried another problem with the 1 at the top position of the problem and a few students still tried to add 8 onto the 1. They quickly discovered that that method was ineffective and the group agreed to modify the strategy to start with the largest addend and then simply add 1 to it (Van de Walle, 160). I encouraged the students to do the counting as much as possible in their head, but if they needed to use their fingers in the beginning that it was okay. Most students found the problems very easy.

Two-More-Than Facts

Not long after the students were introduced to one-more-than facts, I presented a story problem with a two as an addend and I asked them how they would solve the problem (see fig. 6). For some students who had established strategies, their response was simply the answer. However, for most students, the response was to add 2 to the largest addend. Having just worked with a strategy where they added 1 to the largest addend, that type of strategy was fresh in their mind. I continued to stress the importance of counting from the larger number, not simply the top or bottom number. I also continued to encourage the students to add on two mentally, without using their fingers. I was surprised by the challenge this presented for a few students. A few students who could add on one in their head easily, found it difficult to add on two.

Figure 5

			Addition Facts							
+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Figure 6

Two-More-Than Facts

Number Relationships: Students must see that it is much faster to start with a larger number and add on the smaller number than to start with a smaller number and add on a larger number.

Problem: When Tommy was at the circus, he saw 8 clowns come out of a little car. Then 2 clowns came out on a bicycle. How many clowns did Tommy see in all?

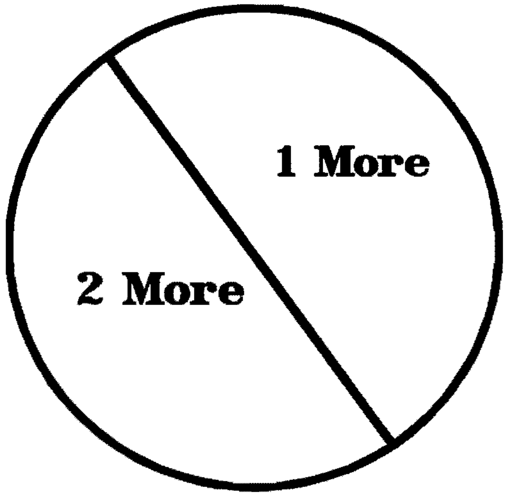
Share Solutions

Strategy: Teach the students to start with the larger number and mentally add two more to that number. In this case, start with 8 and add one more to make 10.

Additional Problem: Steve has 2 blue marbles and 5 red marbles. How many marbles does he have in all?

Considering this, I used one of Van de Walle's suggestions (see fig. 7) and introduced the students to a practice circle (160). The students worked in pairs to take turns practicing their facts that contained at least a one or two addend. Each pair of

Figure 7



students received one circle and a paper clip. One student would say a single-digit number, while the other student spun the paper clip around the tip of a ballpoint pen. When the paper clip stopped spinning, the student who spun had to provide the solution to either one or two more than the number given by the partner. This activity was effective for the class because it allowed them to practice their newly learned ideas in a fun way. The students enjoyed spinning and trying to give the answer as quickly as possible. Periodically, throughout the entire semester, I would give the students three or four minutes to practice with the circles. The time spent practicing always helped remind the students of the strategies they had learned for problems that contained at least one addend that was a one or two.

One important idea I considered while teaching the strategies was that they were introduced to the students in isolation. Yet, when students would encounter problems where they needed to use their strategies, they would not be separated by categories. Keeping this in mind, I provided the students with a practice sheet where they had to differentiate between the different types of problems. On the page, I listed all types of addition facts and asked the students to circle all the one-more-than facts and to draw a box around all the two-more-than facts. After they went through the entire page, they were instructed to go back and answer only the boxed and circled facts. This not only gave the students practice in identifying a problem's category, but it also allowed them to continue to practice their strategies.

An interesting idea was discovered with this first practice sheet. On the page, the problem $\boxed{\begin{array}{r}1\\ \underline{+2}\end{array}}$ appeared. Some students circled the problem because it had a 1 as an addend, while other students boxed the problem because it had a 2 as an addend. The page indirectly allowed me to talk with the students about how some problems can fall into more than one category. I then asked the students which category was the right answer. After some debate, they agreed that both answers were right and that that strategy which worked best for them was the one they should use. I used this moment to explain to the class that if we came to a category of problems and they found a strategy that worked better for them, they should go use it. The most important thing was that the students learned the strategies that were most effective for them.

Facts with Zero

The next category of facts I presented to the students involved facts with at least one addend that was zero (see fig. 8). These were the simplest category of facts that the students practiced during the entire project. When I presented the story problem, they thought it was funny that we talked about a strategy to use with problems with a zero. The whole class agreed that any number plus zero is that number.

Figure 8

			Addition Facts							
+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Figure 9

Facts with Zero

Problem: On Saturday, Billy bought three t-shirts at the store. On Sunday, he did not by any. How many t-shirts did Billy buy over the weekend?

Share Solutions

Strategy: Teach the students that any number plus zero is always that original number.

Additional Problem: Betty had 6 white golf balls and 3 yellow golf balls. How many white golf balls does Betty have altogether?

To help prove that the students already had mastered these problems, I gave them a sheet of thirty problems all containing at least one zero. I started all the students at the same time and asked them to raise their hand when they finished, so that I could time how long it took each student to complete the page. Overall, the class averaged around a second per problem. Even though the problems were easy for the students, I feel that they were a necessary portion to include in the project.

Doubles Facts

The fourth strategy I introduced to the students included the ten facts that involve identical addends (0 + 0 to 9 + 9). These facts were essential for the students to know and understand because they were a key to understanding many of the other strategies.

Figure 10

Addition Facts

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Figure 11

Doubles Facts

Problem: Alec and Zack each found 7 seashells at the beach. How many did they find together?

Share Solutions

Strategy: Teach the students to learn what every number 0 to 9 is doubled.

Additional Problem: For Mother's Day, Shirley received 6 red roses and 6 white roses. How many roses did she receive all together?

Using the information they had already learned, only seven of the ten doubles were new to the students. With these facts, repeated practice was necessary because no real procedure was used to determine the solution. To help the students practice the problems I used Van de Walle's suggestion and created a doubles machine (161). Using index cards with one side containing an addend and the other side containing the solution; I practiced the doubles facts with the students. The machine consisted of showing the students an addend and then putting the card through the machine (putting the card under my desk and making machine noises) and then showing the solution, or doubled side of the index card. Although quite humorous for the students, the doubles machine made practicing the facts fun. After a few days of review with my "machine," I had the students create their own doubles cards. Along with the one- and two-more-than spinners, they practiced the flash cards frequently.

To continue to encourage students to identify and use a specific strategy with an array of different problems, I again created a sheet with many different facts (see Appendix B). This time I had the students circle the one-more-than facts with blue, the two-more-than facts with red, the zero facts with green, and the doubles facts with purple. Not only did the sheet serve as a nice practice for the students, but it also allowed me to determine how the students were progressing through the project. After looking at the sheets, I was pleased to see that overall the students were applying the different strategies they learned.

Near-Doubles Facts

Other than the one- and two-more-than facts, the strategies the students learned were independent of each other. No strategy depended on the knowledge from another strategy. Near-doubles facts are those that have consecutive addends (see fig. 12). In order to use a strategy for these problems, it was important to make sure the students had a firm understanding of the doubles facts. Just like all the other facts, I introduced the students to a story problem and asked them to think about a strategy could be used to solve the addition problem.

Figure 12

			Addition Facts							
+	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Figure 13

Near-Doubles Facts

Problem: Candy Cook made 6 dozen cookies on Monday and 5 dozen cookies on Tuesday. Hoe many cookies did she make altogether?

Share Solutions

Strategy: Teach the students to double the smaller number and add one or double the larger number and subtract one.

Additional Problem: For helping his mother with her work, the young boy earned $7 one weekend and $8 the next weekend. How much money did the young boy earn altogether?

Some students said that they would take the smaller of the two numbers and use that double fact sum and add one to get the solution. In this way, the problem could be seen as a two-step strategy, a doubles fact followed by a one-more-than fact. Other students said that they would take the larger of the two numbers and use that double fact sum and subtract one to get the solution. To help the students see the complicated idea, I drew thought bubbles on the board next to the problem to model how they described their thoughts to me (see fig. 14). The most important idea that I stressed to the students was to use the strategy that was most effective for them personally. This seemed to work out well for the students.

Figure 14

$$\begin{array}{l} 6 \\ \underline{+6} \\ 12 + 1 = 13 \end{array} \qquad \begin{array}{r} 6 \\ \underline{+7} \end{array} \qquad \begin{array}{l} 7 \\ \underline{+7} \\ 14 - 1 = 13 \end{array}$$

<u>Make-Ten Facts</u>

Figure 15

Addition Facts										
+	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

The next set I taught the students were all those facts that have at least one addend of 8 or 9. These facts required the students to use all the ideas that they knew to develop a strategy. More than any other set of facts, these required the students to understand that the numbers greater than ten were ten plus some more. For many students in my class this was a relationship they did not all understand. Before I introduced the new category of problems, we practiced dissecting numbers greater than 10 into ten and some more (17 = 10 + 7). After some practice, I introduced the story problem and I asked the students to think about how they could use what we has just talked about to solve the problem.

Figure 16

Make Ten Facts

Number Relationships: Students must think of the numbers 11-18 as 10 and some more

Problem: Ellen had 8 tomatoes. She picked 4 more tomatoes. How many tomatoes does Ellen have in all?

Share Solutions

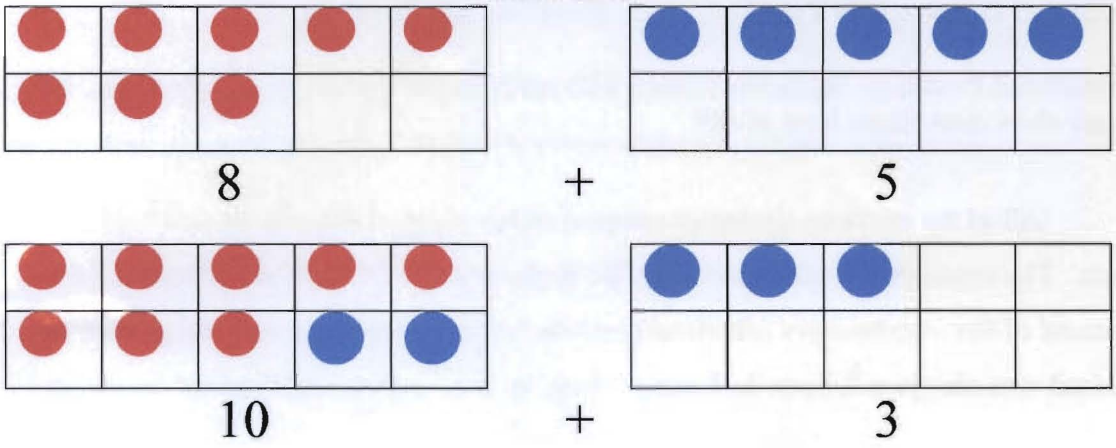
Strategy: Teach the students that one strategy is to build onto the 8 or 9 up to 10 and then add on the rest. For this example, 8 + 4, start with the 8 then add 2 more to make 10. That then leaves 2 more (from the original 4) to make 12.

Additional Problem: Billy has 4 red and white candy canes and 9 blue candy canes. Hoe many candy canes does she have altogether?

After some discussion, we agreed that an effective strategy would be to add to the number 8 or 9 to obtain 10 and then add the remaining amount to that number. Since this was a hard concept for students to see, I used Van de Walle's activity of ten-frames to make the idea more meaningful for the students (163). I gave each student two ten frames and some chips to model the problems (see fig. 17).

Figure 17

Ten-frames



They first started out modeling the original problem and then they moved the necessary chips to fill the first ten frame. Next, they added 10 to the remaining chips in the second frame. We worked through several examples to allow the students to continue to practice the idea.

Remaining Six Facts

Figure 18

				Addition Facts						
+	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Figure 19

Remaining 6 Facts

Problem: The teacher had 4 dollar. Mackenzie gave him 7 dollars. How much money does the teacher have now?

Share Solutions

Strategy: Doubles Plus Two, Make-Ten Extended, and Counting On

Additional Problem: Santa has 6 elves with red hats and 4 elves with green hats. How many elves does Santa have in all?

All of the previous strategies covered eighty-eight of the one hundred addition facts. The remaining twelve facts could be further subdivided into six unknown facts because of the communitive relationship of the facts. Of these six remaining facts, one addend was always a 5, 6, or 7. Because these facts lie in the middle of the matrix, no clear strategy encompassed all of the remaining facts. As a result, I wrote the six remaining facts on the board and I asked the students to think of how they could relate the previous six strategies to the remaining facts. The remaining facts are as follows:

$$\begin{array}{cccccc} 3 & 3 & 3 & 4 & 4 & 5 \\ \underline{+5} & \underline{+6} & \underline{+7} & \underline{+6} & \underline{+7} & \underline{+7} \end{array}$$

Since these problems presented no clear strategy, I had the students think of strategies that they could use on their own. Then I had the students work in small groups to share the strategies they had developed, and finally I had each group report to the class the strategies that they liked best. Through the class discussion, we found a few different options. The students said that three of the facts could be seen as doubles plus two, meaning that they would simply add one more to a near-doubles fact. Some other students suggested that we could extend the make-ten facts to include four of the above facts. Finally, some students suggested counting on as an option when no other strategy would work. Again, just like all of the other facts, the most important thing was for each student to choose the strategy or strategies that worked best for him or her.

Program's Success

Working with the students everyday, it was easy to see that they were improving in their ability to solve their mathematical facts. Over the course of the semester, I witnessed students gaining more confidence in their abilities to answer problems on the board. As I was teaching the mathematics lesson one day, a student responded to a question I had posed about the solution to a problem. Even though we had not talked about mathematics facts that day, the student named the solution and named the mathematics fact category associated with the solution. At that point, I knew my teaching of strategies was starting to gain meaning for the students. They no longer looked at the facts as isolated examples, but instead they saw the broader picture on how what they learned had applications in many of their other mathematics experiences.

Although I could easily tell the progress in the classroom, I wanted clear documentation that the program had in fact been a success for all of the students. To help document my results, I gave the students the initial assessment (see appendix A) at two other times after they had learned all of the fact strategies. Instead of asking them to circle the problems they did not know, as in the initial assessment, I had them complete every problem that they could and record their time when they completed. In order to make sure to monitor the time to obtain accurate results, I had each student raise his or her hand the second they finished the assessment. I then told them the time to record on their page.

The results of the benchmarks were as expected. For the second time through, every student was able to answer every problem with very few mistakes. This was a nice improvement from the first test when some students were not sure of the solutions quickly. As mentioned, I gave the test one additional time approximately three weeks later. The third time, I again timed each student to show their progress. Out of the seventeen students in the classroom, sixteen improved their time from the second to the third assessment. Keep in mind, the tests were identical and they were given nearly three weeks apart. The results clearly proved what I had seen happening in the classroom throughout the semester.

The exciting part was that the class not only improved, but they improved nearly 10% (comparing the total time for the class for each test) from having taken the test just three weeks prior. Another exciting outcome was that the students who were very successful the second time through may have only improved 5 to 10 seconds, while the students who may have struggled the second time through, improved as much as a minute from the previous test. These students were the ones who truly benefited from the program.

The powerful results point out a very important idea. It is essential to continue to practice with the strategies after they are taught. Once all of the strategies were presented, the class spent approximately five minutes every few days reviewing one or two of the strategies. The reviews were very informal and simple. For example, one day the students worked with a partner to review their doubles fact cards. Another day, they worked with the one-more-than and two-more-than spinners. Although the reviews were very simple, they allowed the students to further practice the strategies. The more the students practiced problems using the strategies the more the strategies became second nature for them.

Student Comments

After the completion of the entire program, I sat down with the students one-on-one with their assessments and asked them to reflect on the learning of the strategies. Specifically, I asked each student to give their opinion on the method I used to teach the fact strategies, what they liked or disliked about the program, and how they think it did or did not help them.

Overall, the students were very glad that they learned the new program. The majority of the students commented that they thought the strategies helped them master their mathematics facts and gave them confidence for when they might encounter the facts in the future. One student said, "Learning these new strategies really helped me a lot. It was fun learning what others had to say."

The most common thoughts from the students dealt with their improvement in speed and accuracy from learning the strategies. One student described the program in saying, "I think it helped me because in first and second grade I was slower, I improved." Still another student commented, "It helped me because some facts I did not know I now have a strategy for." From their thoughts, it was clear that the students enjoyed learning the strategies.

Personal Reflections

As I was beginning to establish the details of my implementation of the strategies in the classroom, I was intimidated by the thought of taking the research of a highly respected educator and making it work in my classroom. I had numerous questions about how it would be possible to teach the strategies to the students and more importantly how they would accept my teaching. Even after deciding to teach the strategies, I was not completely confident that they would be effective.

Looking at the entire implementation of the strategies, I could not be happier on progress that was made in the classroom. Many of the students went from having no strategies at all to having an array of possible strategies at their disposal every time they encountered an addition fact. From the documented success of the students and the unanimously positive comments, it was clear that the students did benefit from learning the strategies.

As a future educator, I took many important ideas out of implementing the strategies in the classroom. First, I learned that it is realistic for an elementary teacher to seek out professional resources in use in the classroom. As I mentioned, before introducing this project I would not have felt comfortable enough to try to teach the material in the classroom. I now know that it is possible and many times beneficial for teachers to seek out professional resources to use in the classroom. With this experience, I know feel confident enough to seek out and use professional resources to improve the learning experiences of my students whenever possible. I know that I will be able to find creative and unique ideas that can be used to help reach all students.

Another important consideration when using professional resources that I discovered is that it is important to take the information and modify it to meet the needs of the students in your classroom. Although I modeled my instruction after the research of Van de Walle, I modified some of the practice activities to appeal to the students. For example, Van de Walle suggested using a paper doubles machine. To make the machine appeal to the students, I introduced noises and challenged them to predict the outcome of the machine. Even though this was a small modification, it was an important part of my teaching because it helped to encourage the students to want to participate. Modifying the resource helped to make the project that more meaningful and beneficial for the students.

Other Educators

It is my hope that other educators look at my work and see how I was able to implement the strategies in my student teaching classroom. I hope that they will find the strategies and the activities I used to be beneficial and they will try to implement them in their own classrooms. More than anything else, I hope that they look at the work I have done and learn that it is possible to take professional resources and implement the ideas and strategies in their own classroom. In this way, the teacher truly seeks out the resources required to allow his or her students to achieve as much as possible.

Works Cited

Hanks, Judith E. "An Alternative to Basic-Skills Remediation." by Judith E. Hanks. Teaching Children Mathematics 2 (1996) : 452-58.

Van de Walle, J.A. Elementary and Middle School Mathematics: Teaching Developmentally. 5th ed. Boston, Pearson, 2004.

Appendix A

7 +1	3 +2	9 +0	6 +6	3 +4	7 +3	3 +6	5 +4
3 +0	7 +7	2 +3	1 +9	6 +1	0 +5	1 +1	6 +7
2 +8	7 +4	3 +1	5 +2	1 +0	9 +9	5 +5	1 +9
9 +5	8 +8	4 +9	8 +7	0 +6	6 +3	1 +2	6 +2
4 +0	9 +8	4 +6	7 +5	8 +1	2 +5	8 +0	2 +2
5 +6	2 +0	9 +2	2 +7	3 +4	3 +7	1 +6	2 +8
0 +7	4 +2	4 +4	8 +0	5 +1	3 +3	7 +6	1 +4
1 +6	7 +9	9 +6	8 +5	6 +5	2 +5	1 +3	7 +8

Appendix B

Directions: Circle all the one-more-than facts in blue. Circle all the two-more-than facts in red. Circle all the facts with zero in green. Circle all the doubles facts with purple. Any facts this is more than one type of fact, circle as many times as you can. Finally, go back and complete all of the problems.

1 +4	3 +3	2 +7	2 +1	9 +2	1 +0
0 +2	4 +0	2 +6	1 +1	5 +5	0 +0
3 +3	1 +0	3 +8	2 +2	2 +4	9 +1
8 +8	3 +3	7 +7	7 +2	1 +2	1 +7
6 +2	8 +1	4 +0	3 +1	0 +2	2 +3